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FAIRCHILD SEMICONDUCTOR®

May 2003

FDP6670AL/FDB6670AL

N-Channel Logic Level PowerTrench® MOSFET

General Description

This N-Channel Logic Level MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

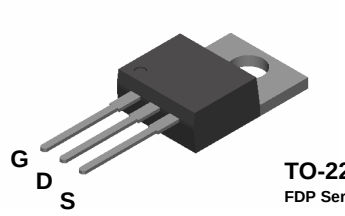
These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(ON)}$ specifications.

The result is a MOSFET that is easy and safer to drive (even at very high frequencies), and DC/DC power supply designs with higher overall efficiency.

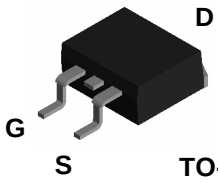
It has been optimized for low gate charge, low $R_{DS(ON)}$ and fast switching speed.

Features

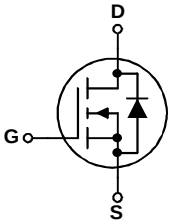
- 80 A, 30 V $R_{DS(ON)}$ = 6.5 mΩ @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 8.5 mΩ @ V_{GS} = 4.5 V
- Critical DC electrical parameters specified at elevated temperature
- High performance trench technology for extremely low $R_{DS(ON)}$
- 175°C maximum junction temperature rating



TO-220
FDP Series



TO-263AB
FDB Series



Absolute Maximum Ratings

T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		30	V
V_{GSS}	Gate-Source Voltage		± 20	V
I_D	Drain Current – Continuous	(Note 1)	80	A
	– Pulsed	(Note 1)	240	
P_D	Total Power Dissipation @ T_C = 25°C		68	W
	Derate above 25°C		0.45	W/°C
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–65 to +175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	2.2	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDB6670AL	FDB6670AL	13''	24mm	800 units
FDP6670AL	FDP6670AL	Tube	n/a	45

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Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings (Note 1)						
W_{DSS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 15 V, I_D = 80 A			114	mJ
I_{AR}	Maximum Drain-Source Avalanche Current				80	A
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		24		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate–Body Leakage	V_{GS} = ± 20 V, V_{DS} = 0 V			± 100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	1	1.9	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		–5		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 40 A V_{GS} = 4.5 V, I_D = 37 A V_{GS}= 10 V, I_D = 40 A, T_J=125°C		5.2 6.5 7.2	6.5 8.5 9.7	mΩ
$I_{D(on)}$	On–State Drain Current	V_{GS} = 10 V, V_{DS} = 10 V	80			A
g_{FS}	Forward Transconductance	V_{DS} = 10V, I_D = 40 A		115		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		2440		pF
C_{oss}	Output Capacitance			580		pF
C_{rss}	Reverse Transfer Capacitance			250		pF
R_G	Gate Resistance	V_{GS} = 15 mV, f = 1.0 MHz		1.4		Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 10V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		13	23	ns
t_r	Turn–On Rise Time			13	23	ns
$t_{d(off)}$	Turn–Off Delay Time			42	68	ns
t_f	Turn–Off Fall Time			15	27	ns
Q_g	Total Gate Charge	V_{DS} = 15 V, I_D = 40 A, V_{GS} = 5 V		24	33	nC
Q_{gs}	Gate–Source Charge			7		nC
Q_{gd}	Gate–Drain Charge			9		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				80	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 40 A (Note 1)		0.9	1.3	V
t_{rr}	Diode Reverse Recovery Time	I_F = 40 A, d_{iF}/d_t = 100 A/μs		34		nS
Q_{rr}	Diode Reverse Recovery Charge			24		nC

Notes:

1. Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%

Typical Characteristics

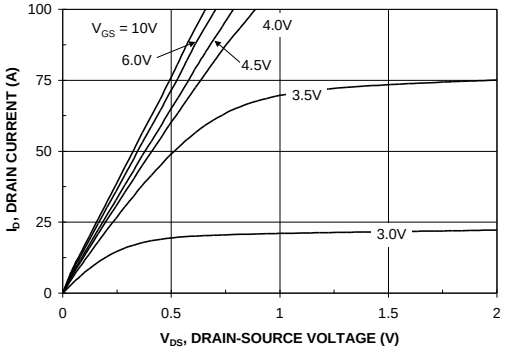

Figure 1. On-Region Characteristics.

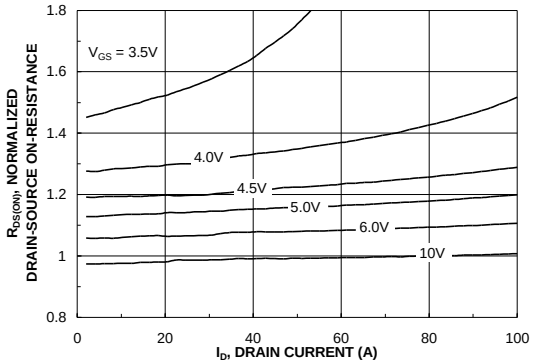

Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

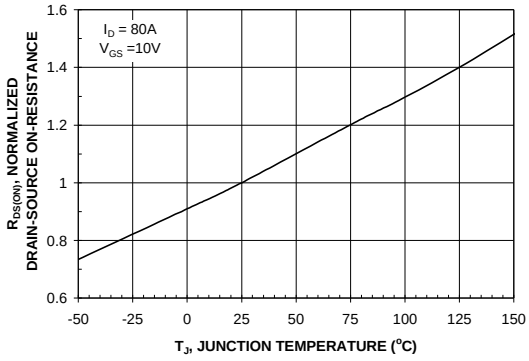

Figure 3. On-Resistance Variation with Temperature.

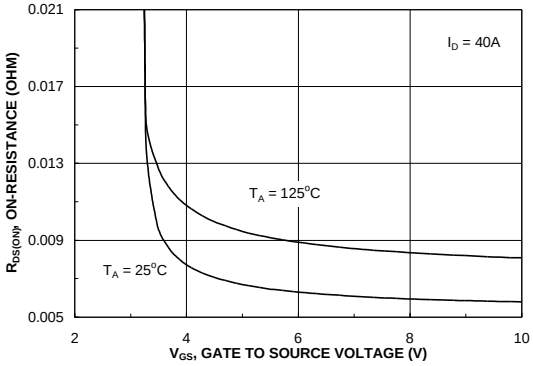

Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

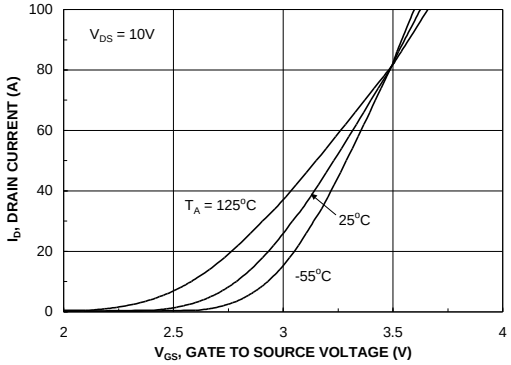

Figure 5. Transfer Characteristics.

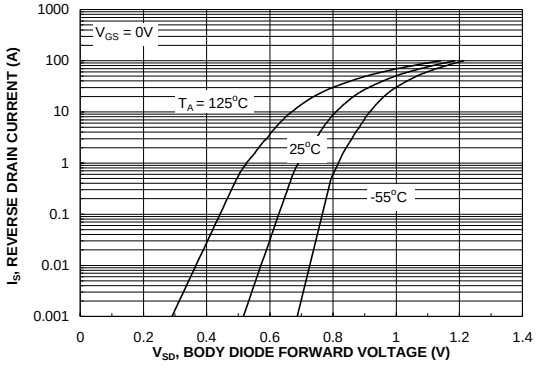

Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

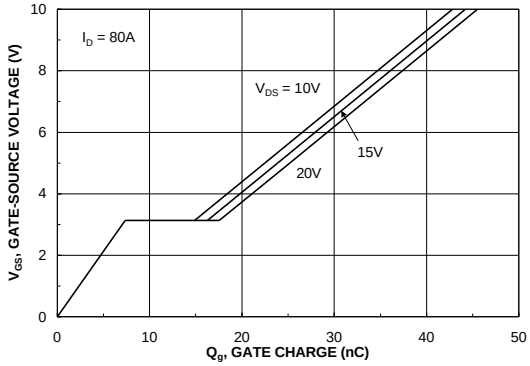

Figure 7. Gate Charge Characteristics.

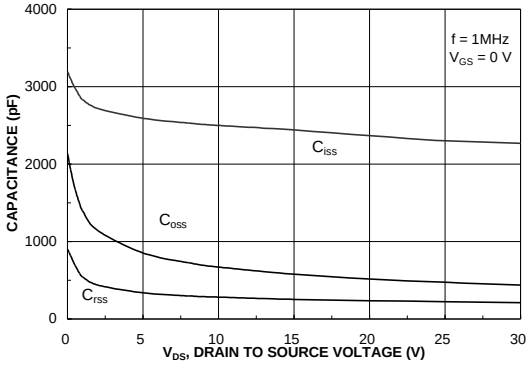

Figure 8. Capacitance Characteristics.

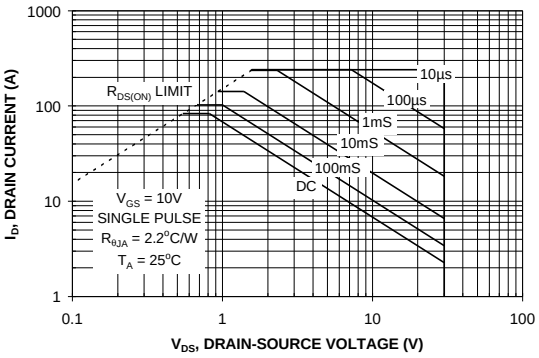

Figure 9. Maximum Safe Operating Area.

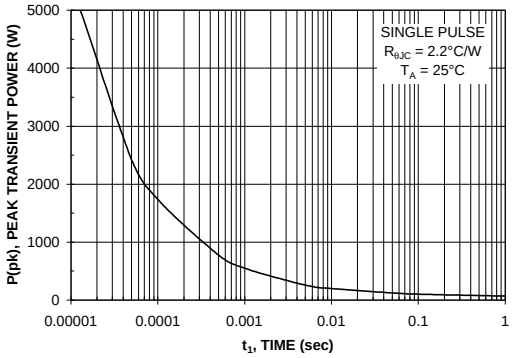

Figure 10. Single Pulse Maximum Power Dissipation.

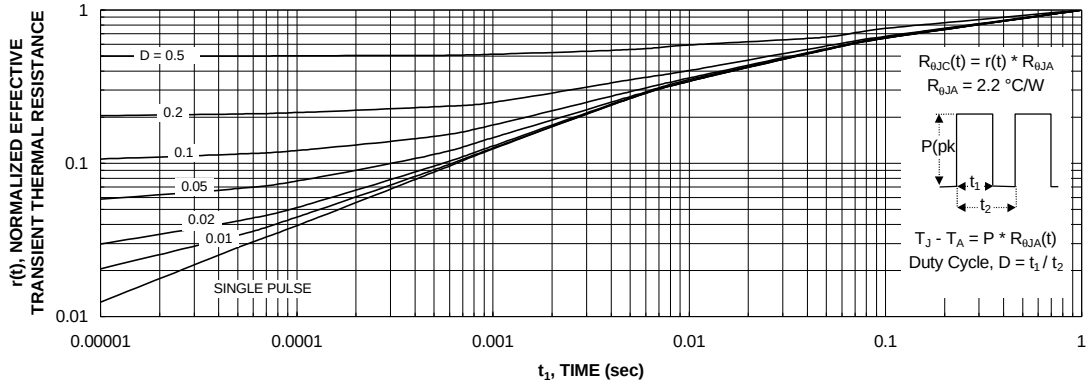

Figure 11. Transient Thermal Response Curve.

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